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Orthodontics and Caries

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1. Introduction

The purpose of orthodontics is to achieve correct dental occlusion, while at the same time improving aesthetic appearance. However, we know today that orthodontic treatment increases the risk of carious lesions, which harm patients and jeopardize the successful outcome of the treatment. The formation of carious lesions as a result of orthodontic treatment can be ascribed to inadequate elimination of dental plaque due to hindrance by intrabuccal appliances.

To forestall these particularly harmful collateral effects, thorough knowledge of how caries form and the associated risk factors is necessary. The risk factors specific to each patient should therefore be accurately evaluated before any orthodontic treatment is undertaken, and then monitored throughout the treatment so that health-damaging carious lesions do not become established.

The aim of this chapter is to define caries and its aetiological factors, pinpoint its various risk factors in orthodontics, describe a preventive, prophylactic approach to be taken before, during and after orthodontic treatment, and make recommendations.

2. Caries

Dental caries is the result of bacteria-induced breakdown of the hard tissues of the tooth by progressive local demineralization (Muller et al,1998; Rillard et al, 2000).

2.1 Etiological factors

The aetiology of caries is multifactorial. Caries are formed under the simultaneous action of several factors (Fig.1): cariogenic bacteria in dental plaque, food, terrain and a time scale sufficient for the carious lesion to grow (Charland et al, 2001).

2.1.1 Cariogenic bacteria

The inside of the mouth and dental plaque contain a broad variety of bacteria. *Streptococcus mutans* is the main micro-organism responsible for human caries. This bacterium uses carbohydrates as a nutrient and energy source, metabolizing them to form lactic acid, which lowers pH and thereby causes the demineralization of tooth enamel (Rillard et al, 2000). This infectious disorder develops with a prevalence that is related to the degree of oral sepsis present.

Fig. 1. Aetiological factors in dental caries

2.1.2 Food

Food plays an essential part in the formation and spread of caries (Haikel & Hemmerle, 1993, 2001). Cariogenic bacteria can survive in the mouth and act there only if they find fermentable food sugars to meet their metabolic requirements *in situ* (Haikel, 2001). Sucrose is the commonest food carbohydrate. It is naturally present in most fruits and vegetables, but is also deliberately added to many food products (Miller et al, 2000).

Essential aetiological food-related factors include the duration of the cariogenic conditions, oral retentiveness and the physical form of the food, the types and concentrations of carbohydrates present, and the patient's eating habits (Droz & Blique, 1999).

2.1.3 Terrain

Dental anatomy can constitute a host-related risk factor. Deficient dental contact points favour the development of dental plaque and caries. Caries can also start in the pits and crevices of the back teeth, which form anfractuous areas that even the finest bristles of a toothbrush cannot easily penetrate.

Saliva also plays an important part in the cariogenic process. Its action is essentially carioprotective, through its mechanical "wash-out" action, responsible for eliminating food waste, and through some of its constituents that act on the remineralization of the enamel. Thus any modification of saliva flow will favour the development of caries (Haikel & Hemmerle, 1993).

Like any disease, caries evolves according to the unstable equilibrium between the intensity of the pathological factors cited above and the biological defence response (Haikel, 1993). Caries appear when the balance between demineralization and remineralization at the tooth surface is disturbed. Dental caries is a dynamic process with periods of progression alternating with stationary phases. This cariogenic process is generally reversible in its initial stages in favourable conditions, but it is irreversible once it has reached an advanced stage (Charland & Salvail, 2003).

2.2 Orthodontic treatment and increased risk of caries

Alongside the usual risk factors for dental caries, orthodontic treatments are also a non-negligible risk factor (Gorton & Featherstone, 2003; Travess et al, 2004; Derks et al, 2007). Introducing a fixed appliance in the mouth favours the build-up of dental plaque, makes oral hygiene very difficult, restricts salivary self-cleaning and so creates an environment that favours the onset of caries (Ahn & Kho, 2003; Derks et al, 2007; Lovrov et al, 2007).

The fitting of orthodontic appliances causes a modification of the oral ecosystem, with an increase in the numbers of cariogenic bacteria (Batoni et al, 2001; Sukontapatipark et al, 2001). This change upsets the balance between the processes of demineralization and remineralization, thereby increasing the patient's individual risk of caries (Fig. 2).

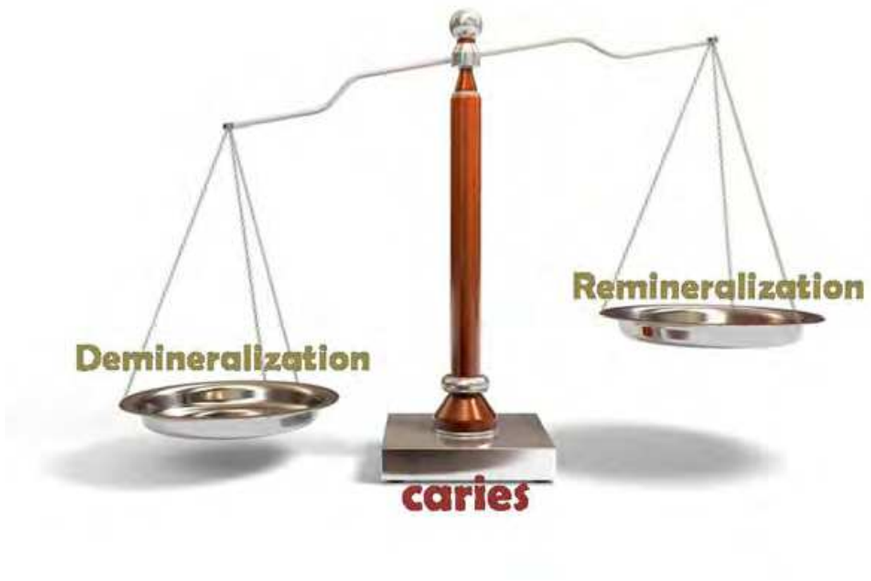

Fig. 2. Increased individual risk of caries in a patient due to imbalance between the processes of demineralization and remineralization.

In addition, orthodontic treatment is most often applied during adolescence, when the permanent teeth have recently erupted and so are more vulnerable to caries because of their young enamel. This greatly compounds the risk of caries, and so orthodontic treatment at this age will favour the formation of carious lesions. These can be caries in pits and grooves, which make up more than 60% of lesions diagnosed according to Chaussain (Chaussain et al, 2009). However, the carious lesions can also be localized on smooth surfaces, giving the amelar demineralization lesions known as "white spots" (Zimmer & Rottwinkely, 2004; Sudjalim et al, 2006). According to Kamp, these "white spots", or initial lesions of the enamel, are present in 25–30% of patients who are following an orthodontic treatment (Jordan, 1998).

The teeth most vulnerable to demineralization are the maxillary incisors and the first permanent molars. The three locations most at risk of demineralization are: the cervical areas, the areas located under the bands and the enamel adjacent to cemented brackets (O'Reilly & Featherstone, 1987; Jordan & LeBlanc, 2002).

This initial lesion that occurs during orthodontic treatment appears clinically as an opaque whitish or greyish halo at the junction between the cement and the enamel, and generally at the gum level at the base of the half moon bracket. If the mineral loss continues, then an irreversible cavity formation ensues (Fig. 3.4.5).

Fig. 3. 4. 5 Patient who had been wearing a brace for 7 years presented for consultation with this buccodental state.

3. Study conducted at the faculty of Dentistry, Casablanca

The department of dentofacial orthopaedics of the faculty of dentistry at Casablanca conducted an internal survey to evaluate the prevalence of dental caries and associated risk factors in orthodontics (Bourzgui et al, 2010). A total of 155 patients were followed up for 3 months and 19 days. Their average age was 21.13 ± 8.22 years. The survey included patients wearing fixed orthodontic appliances with vestibular cemented brackets. Patients fitted with lingual appliances, plates or prosthetic devices, and those displaying tooth tissue abnormalities were excluded. Of the included patients, 27.1% had worn their orthodontic appliances for less than 6 months, 36.8% for between 6 and 18 months and 36.1% for more than 18 months.

All the patients used a toothbrush and toothpaste: 52.3% brushed their teeth three times a day, 63.8% for less than 3 minutes, and 63.9% using the up-and-down method. A mechanical toothbrush was used by 94.2% and an electric toothbrush by 5.8%; 43.9% used no dental floss, inderdental brushes or toothpicks; 88.4% used fluoride toothpaste and 3.9% used fluoride mouthwash, but none used fluoride gels or fluoride varnishes.

Plaque index was between 0.5 and 1 in 33.6% of the patients and between 1 and 1.5 in 36.1%. Overall it was between 0.08 and 2.4 with an average of 1.12 ± 0.48 (Fig. 3).
Gingival index was less 0.5 in 34.9% of the patients and between 0.5 and 1 in 41.2%. Overall it was between 0 and 2 with an average of 0.67 ± 0.43 (Fig. 4).
Excessive consumption of carbohydrates in soft drinks was reported in 31.6% of the patients, and 45.8% were in the habit of snacking essentially on sweetened foods. No preventive sealing of pits and grooves of permanent molars had been carried out on 87.1% of the patients.
Before the orthodontic treatment, 72.2% of the subjects presented caries, and 27.8% of these lesions had appeared during the orthodontic treatment; 89.7% of the caries occurred on the back teeth and 56.7% were occlusal; 7.7% had developed white spots on their teeth during the treatment, on front teeth in 25%, back teeth in 25% and both front and back teeth in 50% of cases.

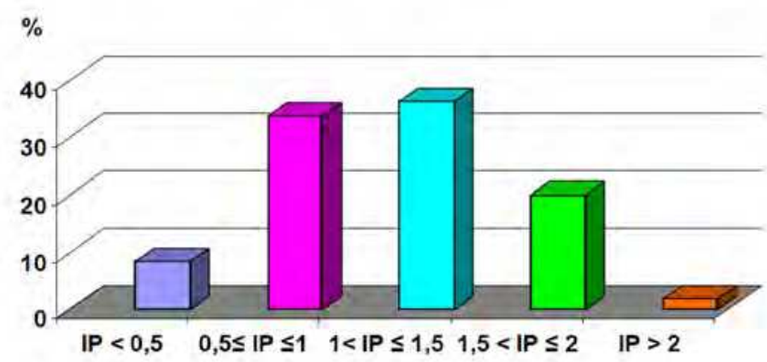

Fig. 6. Distribution of subjects by plaque index

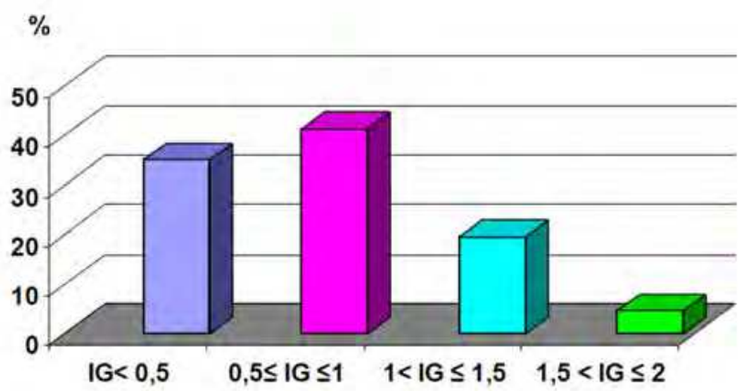

Fig. 7. Distribution of subjects by gingival index

4. Prevention of caries risk in orthodontics

Patients wearing orthodontic appliances should be considered as patients at risk, for whom a preventive, prophylactic approach should be implemented before, during and after the orthodontic treatment (Terrie et al, 2004).

4.1 Before orthodontic treatment

4.1.1 Clinical interview

First of all a clinical interview of the patient should be conducted to determine his or her patterns of behaviour, eating habits, dental hygiene and, if possible, the history of any fluoride treatments undergone (Fortier et al, 1997; Kuhn & Besnault, 2000; Zimmer & Rottwinkel, 2004).

In the case of children, this interview can also assess the degree to which their families are ready, willing and able to help the treatment succeed, an essential factor in ensuring a good quality follow-up of the different treatments proposed (Terk, 1993; Fortier et al, 1997). This interview is followed by a full clinical and radiological dental examination.

4.1.2 Clinical examination

Right at the start the buccodental state should meet certain criteria to facilitate orthodontic treatment and not be likely to cause any local complications that could be wrongly interpreted as being directly due to the orthodontic treatment itself, and so be blamed on it (Fortier et al, 1997).

The role of the practitioner, whether a paedodontist or a general practitioner, is to undertake a systematic search for disorders and abnormalities, both visible and invisible, and make a complete assessment of them.

The dental report: should:

- state the number of teeth present, absent, and treated;
- record all the clinically visible carious lesions and their complications;
- identify any structural abnormalities liable to produce areas of special fragility.

4.1.3 Radiological examination

In addition to the dental examination, an accurate, systematic radiological examination should be performed (Fortier et al, 1997).

Its aim should be:

- to determine the extent of any carious lesions and their possible complications;
- to visualize any relapsed carious lesions under fillings;
- to monitor the progress of apexogenesis or apexification treatment.

4.1.4 Dental care treatment

After this examination, an appropriate treatment plan should be drawn up to carry out the different dental care treatments needed before the orthodontic treatment can in turn be initiated. This pre-orthodontic buccodental preparation is an essential step (Fortier et al, 1997).

The orthodontist should be personally involved at this stage and ensure that all preventive precautions are taken and all necessary treatment is carried out, jointly with the paedodontist or general practitioner.

The following should be performed:
- treatment of all caries;
- treatment of all pulp disorders due to caries;
- restoration of anatomic and functional integrity of teeth used as supports for orthodontic treatment;
- Preventive sealing of grooves, pits and crevices in all permanent teeth (Haikel, 2001; Gontijo et al, 2007).

4.1.5 Education and motivation

Before undertaking curative and preventive treatment, prime importance should be given to dietary recommendations: the patients should be informed and made aware of the cariogenic potential of foods and bad eating habits such as snacking, and be taught to eat sensibly (Blique & Droz, 1999; Miller & Blique, 2000).

In addition, motivation and awareness of buccodental hygiene should be emphasized in the treatment plan. The patient should display a satisfactory level of oral hygiene before the orthodontic treatment is started, and be expected to maintain this level of hygiene throughout the treatment (Burkland, 1999; Sukontapatipark et al, 2001). The rules of hygiene should become a routine habit, which should even so be reinforced at intervals.

Fig. 8. Patient with dental crowding; preparation before orthodontic treatment

Fig. 9. Maintenance of buccodental hygiene during treatment

Fig. 10. End of orthodontic treatment with a satisfactory aesthetic outcome and healthy enamel.

4.2 During orthodontic treatment

Special attention should be paid to the choice of bonding material and to fluoride-based prevention.

4.2.1 Fitting of the orthodontic appliance

The close fitting of bands on teeth is recommended, but this is sometimes insufficient to maintain the protection of the cement if pressure and chewing impact are high (Terk, 1993). Glass ionomer cement has been used for some years and offers a good solution to this problem. It is less friable than oxyphosphate, bonds equally to metal and enamel, and releases fluoride, thus helping to protect the teeth. Its use marks an important advance that greatly reduces the occurrence of demineralization under bands (Evrenol et al, 1999).

Successful outcome of orthodontic treatment also depends on the quality of bracket bonding. Cementing of brackets should always be preceded by treatment of amelar surfaces with prophylactic brushing to remove plaque and other debris. Satisfactory bonding is obtained using phosphoric acid combined with composite resin. The choice of cementing material should take into account both bonding strength and cariostatic power. Composite resins are generally most often used, but studies have shown that bacterial plaque builds up more readily on these resins than on enamel, which can cause demineralization around the brackets.

Glass ionomer cements can also be used to cement brackets: the teeth need no prior acid etching and there is no change in amelar surfaces after removal. Results show a significant reduction in carious lesions when a glass ionomer cement is used to cement orthodontic brackets. The use of this material also significantly reduces the number of white spots observed after removal of the appliance (Dubroc et al, 1994; Donly et al, 1995; Foley et al, 2002; Pascotto et al, 2004; Benson et al, 2005; Cacciafesta et al, 2007; Sudjalim et al, 2007; Lin et al, 2008). Fluoridated bonding resins have anticariogenic power, reducing the occurrence of demineralization adjacent to orthodontic devices by releasing fluoride at

specific sites (Evrenol et al, 1999; Wilson & Donly, 2001). The use of this material should thus be encouraged during orthodontic treatment, especially in patients with high levels of *Streptococcus mutans*.

When braces are removed, excess composite remaining on the teeth must be eliminated: if left in place it will retain bacterial plaque and favour caries formation. Likewise, the peripheral joint should be well chamfered to facilitate saliva flow and tooth brushing.

4.2.2 Buccodental hygiene

Clinical maintenance is essential throughout any orthodontic treatment. Elimination of plaque and food debris is a foremost requirement for buccodental hygiene (Fortier et al, 1997; Haikel , 2001). Concern for oral hygiene should be constant, not only among all practitioners, but also among patients: throughout the treatment period the patient should successfully maintain a satisfactory level of oral hygiene despite the hindrance of the appliance.

Teaching the patient to achieve good oral hygiene, plus follow-up by the orthodontist, is certainly the easiest preventive therapy that can be set in place (Alexander & Ripa, 2000; Kuhn & Besnault, 2000). A method of brushing teeth should be taught that takes into account the patient's age (young child or adult), socio-cultural level, dexterity and any disabilities (Kuhn & Besnault, 2000; Adel Lees, 2003; Zuhal, 2006; Ay et al, 2007). Electrically operated brushes may be preferred if the patient is unable to ensure correct oral hygiene by simple mechanical brushing (Petersson, 2000; Costa et al, 2007); an electric toothbrush reduces dental plaque more completely than a mechanical toothbrush (Kaklamanos & Kafkas, 2008).

Tooth brushing should be done with a fluoridated toothpaste, as it is currently acknowledged that fluoridated toothpastes exert a cariostatic effect (Sommermater & Bigeard, 1993; Arnold et al, 2006; Farhadian et al, 2008). The use of a fluoridated toothpaste appreciably reduces dental plaque, and increases fluoride levels in the biofilm, where it acts as a powerful inhibitor of several bacterial enzymes. The need for at least two daily brushings should be emphasized in order to favour a continuous exchange of fluoride ions between the salivary medium and the enamel surface (Sommermater & Bigeard, 1993; Farhadian et al, 2008). The use of fluoridated toothpastes can reduce the frequency of caries by 15–30%, the best results being obtained with high-fluoride toothpastes (Modesto et al, 2000; Derks et al, 2004).

The follow-up of oral hygiene also allows an appraisal of the patient's motivation. In some particularly unfavourable cases, where the quality of hygiene is inadequate or even severely lacking, the orthodontic treatment should de discontinued with no hesitation, temporarily or definitively, based on an assessment of the likelihood of achieving a healthy buccodental state, adequate motivation and improved oral hygiene and eating habits (Fortier et al, 1997). This approach will forestall the occurrence of not only caries but also parodontal lesions that can take various forms (hyperplasic gingivitis, receding gums, etc.).

For the interproximal areas, which are difficult to get at, there are other ways to eliminate plaque (Petersson, 2000; Haikel, 2001). The use of orthodontic dental floss and interdental brushes is necessary in addition to brushing. Water jets have shown undeniable efficacy for eliminating food debris and form an excellent adjunct to mechanical brushing, being particularly recommended for wearers of appliances.

orthodontiques (Haikel , 2001).

Fig. 11. Photograph at the start of treatment; presence of bacterial plaque due to poor hygiene

Fig. 12. Good oral hygiene before fitting of brackets

Fig. 13. Regular maintenance of oral hygiene throughout the orthodontic treatment.

4.2.3 Control of dental plaque by professional prophylactic cleaning

Besides oral hygiene at home, professional prophylactic cleaning is designed to reduce bacterial load, enhance the efficacy of brushing and facilitate cleaning by the patient (Kuhn & Besnault, 2000; Arnold et al, 2006). Professional tooth cleaning two or three times a year maintains a healthy mouth and reduces the number of caries (Petersson, 2000). It allows proper cleaning of the areas that are hard for the patient to brush.

The coronal surfaces can be polished using fluoridated pastes of progressively finer particle size, and elastomer polishing cups or brushes, to impede the mechanical retention of bacteria (Arrow, 1998).

4.2.4 Screening for caries

Whatever type of appliance is used, the attack of hard tissue, when it occurs, starts by demineralization of the enamel. With multibracket appliances this attack can begin close to cemented brackets or under bands when the cement breaks down and mouth fluids get between the metal and the enamel, where proper cleaning is impossible. (Terk, 1993). Thus the joints between back teeth and bands should be regularly inspected to prevent salivary percolation. If there is any doubt about the quality of the seal the bands should be removed and refitted (Fortier et al, 1997).

4.2.5 Sealing of pits and crevices

Pits and crevices are especially vulnerable to dental caries. These anfractuous areas cannot be readily brushed out and topical fluoride application provides only weak protection (Sommermater & Bigeard, 1993). Caries can always be prevented by sealing grooves, pits and crevices in all growing permanent teeth: premolars and especially the second permanent molars that erupt during orthodontic treatment (Fortier et al, 1997).

The purpose of sealing grooves and crevices on the occlusal faces of teeth is to reduce the bacterial load by smoothing highly anfractuous occlusal shapes that favour food and bacteria retention, and thereby making cleaning easier (Kuhn & Besnault, 2000).

4.2.6 Topical fluorotherapy

The favourable action of fluorides is now well established. The fluoride ion has a preventive effect against caries (Haikel & Hemmerle, 2001; Featherstone, 1999; Modesto et al, 2000; Kuhn et Besnault, 2000; Miller et al, 2004(a), 2004(b); Farhadian et al, 2008). It:

- modifies bacterial metabolism in dental plaque, by inhibiting some enzyme processes;
- inhibits the production of acids, by acting on the composition of the bacterial flora and (or) on the metabolic activity of micro-organisms;
- reduces demineralization and favours the remineralization of early carious lesions, by exerting a remineralization effect, especially at low concentrations. During recurrent episodes of lowered pH, the incorporation of fluoride in the surface layers of the enamel is facilitated (Benson et al, 2004, 2005; Sudjalim et al, 2007).

The main cariostatic effect of topical fluoride preparations is due to the formation of calcium fluoride, which precipitates onto healthy surfaces or in the micropores of active lesions that are not yet at the cavity stage. When the amelar surface is exposed to fluoride, fluoride ions adhere to the surface and form crystals of calcium fluoride. These then act as potential reservoirs from which fluoride can be released (Evrenol et al, 1999; Farhadian et al, 2008).

The more fluoride that is supplied in the first days of treatment, the better will be the structure of the calcium fluoride crystals formed. This is why it is most important to treat the enamel with fluoride just after acid etching (Evrenol et al, 1999).
The prophylactic action of fluoride depends on its concentration, but even more so on the frequency with which it is supplied to the mouth. The topical effects of fluorides are cumulative: the more a tooth is exposed to fluorides, the more resistant to caries it becomes (Sommermater & Bigeard, 1993; Farhadian et al, 2008). Even a small increase in fluoride concentration in the saliva and the plaque can provide a high protection against caries by favouring remineralization. Fluoride can be retained in the saliva at concentrations in the range 0.03–0.1 ppm for 2–6 hours (Featherstone, 1999). Thus in addition to the use of fluoride toothpaste, certain newly-formed shallow surface lesions can be treated early in the course of orthodontic treatment by topical application of painted varnishes, gels or fluoridated solutions to stimulate the remineralization of the enamel surface.

4.2.6.1 Mouthwashes

The use of fluoridated mouthwashes is the commonest method to help prevent caries (Benson, 2005). Fluoridated mouthwashes reduce demineralization and increase remineralization of the enamel near orthodontic bands and brackets (Adair, 1998). There are several different ways to use fluoridated mouthwashes. They can be administered (Sommermater & Bigeard, 1993; Petersson, 2000; Farhadian et al, 2008):

- in low doses (0.05% NaF) at frequent intervals, once or twice a day;
- in high doses (0.2% NaF), once a week or twice a month.

The reduction of caries is 25–30% (Haikel, 2001; Modesto et al, 2000).
For Zero et al. (Featherstone, 1999), NaF mouthwashes (0.05%–225 ppmF) used for 1 minute increase fluoride levels in saliva for 2–4 hours.

4.2.6.2 Fluoride gels

In fluoridated gels the concentration of fluoride can range from 10,000 to 20,000 ppm. These gels are most often acidified preparations of NaF, which favour ion exchange (Wilson & Donly, 2001). Their efficacy depends on how readily accessible the areas to be treated are: the vestibular and lingual areas are obviously best protected (Kuhn & Besnault, 2000).
High-fluoride gels (up to 20,000 ppm such as Fluocaril bi-fluoré 2000*) are applied using trays fitted by the practitioner and used in the dental surgery (Sommermater & Bigeard, 1993; Farhadian et al, 2008). It is recommended to leave the trays in place for 4 minutes; the patient must not mouth-rinse, drink or eat for an hour or an hour and a half after application of the fluoride gel. Two applications a year are recommended (Haikel, 2001).

4.2.6.3 Fluoride varnishes

Fluoride varnishes are used preventively around cemented brackets to reduce the cariogenic effects of bacterial plaque at the most vulnerable sites such as proximal edges and cervical surfaces (Fortier et al, 1997; Vivaldi-Rodrigues et al, 2006; Gontijo et al, 2007; Farhadian et al, 2008; Shafi, 2008; Martinez-Mier, 2009). They do not elicit the patient's cooperation.
These varnishes were developed to adhere to the enamel surface for long periods (up to 12 hours or more) and release their fluoride slowly on the enamel surfaces, so reducing the time spent by the patient in the dentist's chair (Sommermater & Bigeard, 1993; Haikel, 2001; Schmitt et al, 2002; Demito et al, 2004; Stecksen-Blicks et al, 2007).
Fluoride varnishes are usually applied twice a year on specific areas with incipient lesions on smooth surfaces.

Three types of varnish are currently on the market:
- Fluor Protector* with 0.1% fluoride,
- Duraphat* with 2.2% fluoride,
- Bifluoride* with 5% fluoride.

Fluoride varnishes should be used in weakly motivated patients in an intensive treatment schedule (three days running), repeated every three or four months, or twice or three times a year. The varnishes are thus used as a preventive measure to reduce demineralization of the enamel around the brackets, promote the remineralization of the carious lesions and avert further lesions (Petersson, 2000; Gontijo et al, 2007; Farhadian et al, 2008).

4.2.6.4 Combined fluoride varnishes and chlorhexidine

Control by antimicrobial agents has also given excellent results in combination with fluoride in high-risk patients (Petersson, 2000; Haikel, 2001; Alves et al, 2008). Fluoride and chlorhexidine form a powerful combination: the fluoride acts to protect the hard tissues, while the chlorhexidine reduces buccal pathogens present in the saliva and dental plaque (Petersson, 2000; Ogaard et al, 2001; Beyth et al, 2003; Attin et al, 2006; Derks et al; 2008)

Antibacterial varnishes (1% such as Cervitec*) are applied locally on at-risk sites, e.g. incipient lesions that have to be cleaned up to allow remineralization (Haikel, 2001; Kuhn & Besnault, 2000). They lower the numbers of *Streptococcus mutans* in the plaque close to fixed appliances (Madlena et al, 2000; Alves et al, 2008; Derks et al, 2008).

Applying a chlorhexidine-based varnish is straightforward. It is painted on with a brush and dried on the tooth surface with a gentle air stream. The patient then has to wait at least one hour after application of the varnish before eating or drinking (Petersson, 2000).

Like gels, chlorhexidine varnishes have to be applied repeatedly, two or three times in the space of a few days, and every three or four months to be effective.

The combined use of an antibacterial varnish and a fluoride varnish is more efficacious in averting new carious lesions (Ogaard et al, 2001).

4.2.7 Maintenance and follow-up during orthodontic treatment

The odontologist should remain fully involved throughout the orthodontic treatment, and draw up a follow-up schedule jointly with the orthodontist and the patient to keep the risk of caries at a low level. Thus regular maintenance consultations with the odontologist must be planned. This follow-up schedule should be adapted to each patient's individual risk of caries. For children at very low risk, two or three annual visits are recommended. For children at higher risk, a visit every 2 months will be necessary.

4.3 After orthodontic treatment

The treatment ends when the planned result has been achieved (Fortier et al, 1997). After the brackets have been removed, residues of cement remain on the teeth, requiring a thorough polishing of the dental surfaces (Osorio et al, 1998).

The paedodontist or general practitioner should then carry out a careful examination of the entire mouth to diagnose and treat:
- any proximal caries;
- any caries that have formed under the molar bands and in areas where brushing between the brackets and the gingival festoon has been deficient.

Traces of demineralization, which cannot be foreseen, are often discovered at the end of treatment, requiring continued preventive fluoride treatment (Terk, 1993). In this case it is

important to make topical applications of fluorides in a solution, gel or varnish to facilitate surface remineralization of incipient carious lesions. If there are no lesions, in the most favourable cases these applications are the only precautions that need to be taken at the end of the orthodontic treatment (Fortier et al, 1997; Willmott, 2004). O'Reilly and Featherstone (Featherstone, 1999) have shown that demineralization around the brackets can be completely eliminated by a combination of fluoride toothpaste and daily rinsing with 0.05% NaF solution.

Another study (Kleber et al, 1999) concerning remineralization with fluoride after removal of orthodontic devices has shown that:

- the use of a fluoride toothpaste twice a day leads to remineralization after 2 months;
- combining fluoride toothpaste and fluoride gels speeds up remineralization (1 month).

5. Conclusion and recommendations

Patients wearing orthodontic appliances should be considered as being at high risk of dental caries. Thus before starting an orthodontic treatment, it is essential to treat all existing tooth decay. Pits and crevices in first and second permanent molars should be filled with a sealant in all patients younger than 20 years old who are at high cariogenic risk.

A screening and consultation schedule should be presented to the patient and parents. Clinical and radiological examinations (retroalveolar and retrocoronal views) should be performed to look for white spots and caries.

The orthodontist should teach the patient to use a suitable brushing method. The use of interdental brushes and dental floss should be encouraged, besides brushing teeth after every meal. Emphasis should be placed on the importance of diet, and patients should be encouraged to reduce their sugar consumption.

Prophylaxis with topical fluoride application should be implemented: high-fluoride toothpastes, fluoride mouthwashes, gels and varnishes during and after the orthodontic treatment, especially for patients at high cariogenic risk.

Finally, close collaboration throughout with paediatric odontologists and conservative dentists is indispensable.

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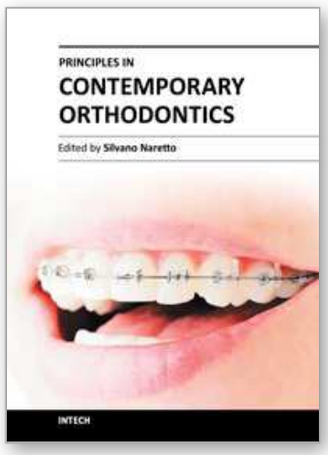

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Orthodontics is a fast developing science as well as the field of medicine in general. The attempt of this book is to propose new possibilities and new ways of thinking about Orthodontics beside the ones presented in established and outstanding publications available elsewhere. Some of the presented chapters transmit basic information, other clinical experiences and further offer even a window to the future. In the hands of the reader this book could provide an useful tool for the exploration of the application of information, knowledge and belief to some orthodontic topics and questions.

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